

NO-A179 250

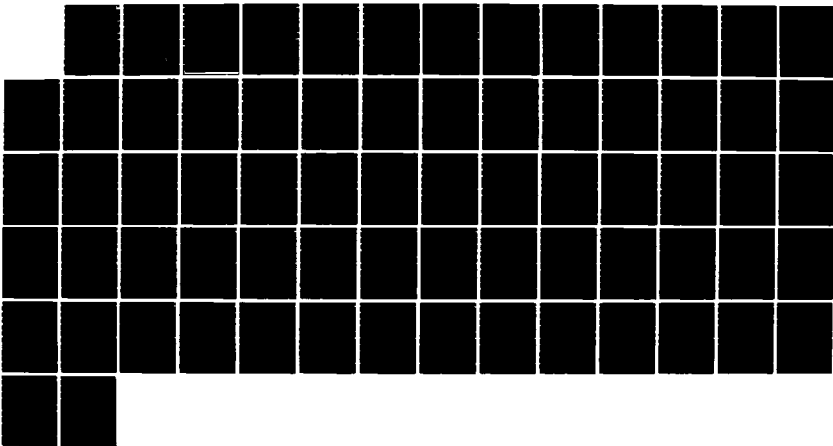
EAST EUROPEAN ERGONOMICS(U) REPORT STORE LAWRENCE KS
D HANN ET AL. MAR 87 HEL-FI-1-87 DAAL02-86-C-6033

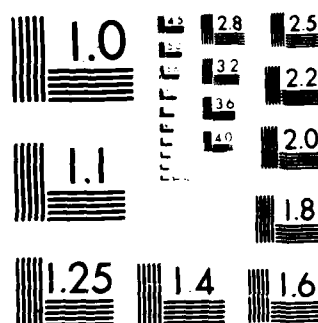
1/1

UNCLASSIFIED

F/G 5/5

NL





MICROCOPY RESOLUTION TEST CHART
 NATIONAL BUREAU OF STANDARDS-1963-A

AD-A179 250

EAST EUROPEAN ERGONOMICS

Prepared for

Foreign Science and Technology Center
U.S. Army Human Engineering Laboratory

U.S. Army LABCOM
Contract No. DAALO2-86-6033

by

The Report Store
Suite 503
910 Massachusetts Street
Lawrence, Kansas 66044

March, 1987

DTIC FILE COPY

DTIC
ELECTE
MAR 30 1987
A

This document has been approved
for public release and its sale
distribution is unlimited

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

A179250

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED			1b. RESTRICTIVE MARKINGS NONE; APPROVED FOR PUBLIC RELEASE		
2a. SECURITY CLASSIFICATION AUTHORITY NA			3. DISTRIBUTION/AVAILABILITY OF REPORT UNLIMITED		
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE NA			5. MONITORING ORGANIZATION REPORT NUMBER(S) HEL FI 1-87		
4. PERFORMING ORGANIZATION REPORT NUMBER(S) NA			6a. NAME OF PERFORMING ORGANIZATION THE REPORT STORE		
6b. OFFICE SYMBOL (If applicable)			7a. NAME OF MONITORING ORGANIZATION HEL FIELD OFFICE		
6c. ADDRESS (City, State, and ZIP Code) SUITE 503 910 MASSACHUSETTS ST LAWRENCE, KANSAS 66044			7b. ADDRESS (City, State, and ZIP Code) 220 7TH ST CHARLOTTESVILLE, VA 22901-5396		
8a. NAME OF FUNDING/SPONSORING ORGANIZATION HEL FIELD OFFICE			8b. OFFICE SYMBOL (If applicable) SLCHE-FI		
9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER DAA02-86-6033			10. SOURCE OF FUNDING NUMBERS		
9c. ADDRESS (City, State, and ZIP Code) 220 7TH ST CHARLOTTESVILLE, VA 22901-5396			PROGRAM ELEMENT NO. 62716A	PROJECT NO.	TASK NO.
11. TITLE (Include Security Classification) EAST EUROPEAN ERGONOMICS			12. PERSONAL AUTHORITIES DAVID HANN, DR BERNARD O. WILLIAMS, LEE WASCHER		
13a. TYPE OF REPORT FINAL			13b. TIME COVERED FROM TO		14. DATE OF REPORT (Year, Month, Day) MAR 1987
15. PAGE COUNT 63			16. SUPPLEMENTARY NOTATION		
17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)		
FIELD	GROUP	SUB-GROUP	ERGONOMICS CEMA HUMAN FACTORS COUNCIL FOR MUTUAL ECONOMIC AID DATABANK BULGARIA POLAND		
19. ABSTRACT (Continue on reverse if necessary and identify by block number)			CZECHOSLOVAKIA ROMANIA GERMAN DEMOCRATIC REPUBLIC USSR HUNGARY		
This report consists of four parts. The first part depicts the international composition of CEMA contributors to <u>Ergonomics: Principles and Recommendations</u> . The second part describes CEMA cooperation to develop an ergonomics databank. Part three describes CEMA efforts to set up an international scientific databank. Part four describes institutions and research relating to ergonomics in Eastern Europe.					
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT <input checked="" type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS			21. ABSTRACT SECURITY CLASSIFICATION Unclassified		
22a. NAME OF RESPONSIBLE INDIVIDUAL LEE WASCHER			22b. TELEPHONE (Include Area Code) (804) 296-5171		22c. OFFICE SYMBOL SLCHE-FI

DD FORM 1473, 84 MAR

83 APR edition may be used until exhausted.
All other editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE
UNCLASSIFIED

E A S T E U R O P E A N E R G O N O M I C S

Prepared for

Foreign Science and Technology Center
U.S. Army Human Engineering Laboratory

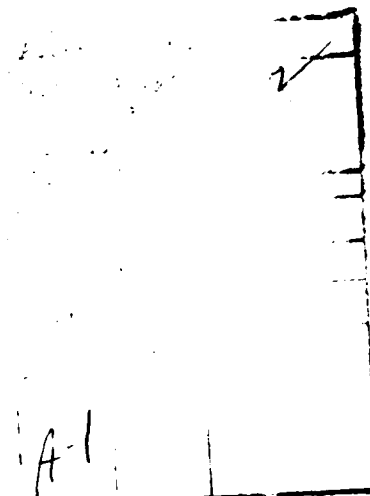
U.S. Army LABCOM
Contract No. DAALO2-86-6033

by

David Hann, Bernard O. Williams, Ph.D.

The Report Store
Suite 503
910 Massachusetts Street
Lawrence, Kansas 66044

March, 1987



EAST EUROPEAN ERGONOMICS

abstract

This report consists of four parts. The first part depicts the international composition of CEMA contributors to Ergonomics: Principles and Recommendations. The second part describes CEMA cooperation to develop an ergonomics databank. Part three describes CEMA efforts to set up an international scientific databank. Part four describes institutions and research relating to ergonomics in Eastern Europe.

PREFACE

This report surveys the status of ergonomic data in the Eastern European member nations of the Council for Mutual Economic Aid. During 1986, letter inquiries were sent to forty-seven scientists in the seven CEMA countries: Bulgaria, Czechoslovakia, the German Democratic Republic, Hungary, Poland, Romania, and the USSR. Two responses from Hungary and six from Poland provided useful information about current activities, but this slight response forced us to rely primarily on published descriptions of human factors activities in the Eastern Bloc.

The main text of the report describes four aspects of ergonomics in Eastern Europe. The first part describes a 1983 ergonomics handbook for designers written by one-hundred and eight authors from the CEMA countries. The second part describes the cooperative efforts of CEMA nations in the collection and maintenance of ergonomics data. The third part identifies the Eastern European activities in international networking of scientific databases. The fourth part identifies the institutions and research activities pertinent to ergonomics in the seven CEMA countries.

The bibliography lists publications used in this survey and also works identified by the survey.

The Index of Research Topics lists the page reference for approximately 300 terms.

CONTENTS

ABSTRACT.....	ii
PREFACE.....	iii
I. <u>Ergonomics: Principles and Recommendations</u>	1
II. CEMA Efforts to Develop Ergonomics Databanks.....	7
III. International Databank Network.....	9
IV. Survey of East European Ergonomics.....	10
Bulgaria.....	10
Czechoslovakia.....	13
German Democratic Republic.....	17
Hungary.....	24
Poland.....	31
Romania.....	37
USSR.....	40
V. Bibliography.....	49
VI. Ergonomics Research Topics Index.....	57

EAST EUROPEAN ERGONOMICS

This report discusses four aspects of ergonomics in Eastern Europe. The first part describes a group effort to produce a reference book on ergonomics by scientists of CEMA member countries. (The acronym CEMA, representing Council for Mutual Economic Aid, is also rendered CMEA). The second part of the report describes cooperative efforts of CEMA countries regarding ergonomics data. The third part of the report describes plans and efforts on the part of CEMA countries to develop an international network of scientific databases. While the international network effort is not concerned solely with ergonomics databases, ergonomics will probably be included in the network. The fourth part of the report summarizes J.L. Seminara's surveys of East European ergonomics conducted over a ten-year period. Seminara's survey is supplemented with two papers by V.L. Munipov in Applied Ergonomics, (1978 and 1984), Anthony J. Cacioppo's keynote address on Soviet Human Factors at the 1986 Human Factors Society Annual Meeting, and information obtained from correspondence with East European scientists during 1986.

I. Ergonomics: Principles and Recommendations

The group effort of CEMA countries culminated in a 1983 handbook titled Ergonomics: Principles and Recommendations. One hundred and eight writers from Bulgaria, Czechoslovakia, the German Democratic Republic, Hungary, Poland, Romania, and the USSR collaborated on the project. This book reflects the existing "database" of ergonomic research in the CEMA countries. In general, the available data appears in aggregated form only, in the literature, with on-site databases used for specific purposes, as is currently the case for ergonomics research in the West.

Ergonomics: Principles and Recommendations considers the theoretical and methodological basis of ergonomics. The preface says the book is intended to be for planners, designers, architects, specialists in organization, worker protection, standardization and guidance of quality of industrial production; and also for specialists in ergonomics, engineering psychology, physiology and work hygiene. The handbook was published by the USSR State Committee on Learning and Technical Methods, 1983, Moscow.

The book was edited by an international editorial collegium:

V.M. Munipov, USSR, president of the collegium,
V.P. Zinchenko, USSR,
L.A. Kuzmichev, USSR,
Tu.B. Soloviev, USSR,
N. Tsaneva, People's Republic of Bulgaria,
A. Zeleny, Czechoslovak Socialist Republic,
F. Makher, German Democratic Republic,
L. Bartov, Hungarian People's Republic,
D. Kozadecka, Polish People's Republic.

Translation of
Ergonomics: Principles and Recommendations

Table of Contents

- Chapter 1. Ergonomics--Discipline of a New Type
Section 1 Objective Reason of Origin of Ergonomics
Section 2 Subject, Structure and Basic Problems of Ergonomics
Section 3 Characteristics of Human Factors
- Chapter 2. Methodological Basis of Ergonomic Protection of the Man-Machine System
- Chapter 3. General Ergonomic Demands to the Man-Machine System
Section 1 Working Places and Technical Means of Activity
Section 2 Means of Representation of Information
Section 3 The Organs of Management
Section 4 Production Medium
Section 5 Principles of Organizing Work for the Handicapped
- Chapter 4. Ergonomic Bases of Man-Machine System Exploitation
- Chapter 5. Ergonomic bases of Standardization and Evaluation of Industrial Production Quality
Section 1 Standardization of Ergonomic Norms and Demands
Section 2 Ergonomic Evaluation of the Quality of Production

Contributors to Ergonomics: Principles and Recommendations

Chapter 1. Ergonomics, Discipline of a New Type

Section 1. Objective Reason of Origin of Ergonomics

Bulgaria	N Boshev, I Popov
Czechoslovakia	M Klivar
GDR	F Macher
USSR	N Alekseev, V Davydov, A Leonova, Y Moykin, V Munipov, I Semenov, A Shein, Y Solov'ev, B Yudin, V Zaretskiy, V Zinchenko

Section 2. Subject, Structure and Basic Problems of Ergonomics

GDR	V Bachmann
Hungary	T Hodos
USSR	N Gordeeva, V Gordon, V Munipov, G Solntseva, G Vuchetich, G Zarakovskiy, V Zaretskiy, V Zinchenko

Section 3. Characteristics of Human Factors

USSR	A Leonova, V Medvedev
------	-----------------------

Chapter 2. Methodological Basis of Ergonomic Protection of the Man-Machine System

Bulgaria	V Konstantinov
Czechoslovakia	M Klivar
USSR	N Alekseev, A Frumkin, A Grashin, G Gribanova, L Kuz'michev, A Leonova, V Leont'ev, V Makushin, N Mayzel, A Medenkov, V Munipov, N Rudny, A Sapegin, D Shchelkunov, P Shlaen, V Sidorenko, G Smolyan, A Sovetov, B Tenyushev, E Tushkin, G Zarakovskiy

Contributors to Ergonomics: Principles and Recommendations
(cont)

Chapter 3. General Ergonomic Demands to the Man-Machine System

Section 1 Working Places and Technical Means of Activity

Bulgaria	N Gradinarov, S Mustafov
Poland	J Slowikowski, Z Zbichorski
USSR	O Chernysheva, A Strokina

Section 2 Means of Representation of Information

Bulgaria	A Trendafilov,
Czechoslovakia	P Janecek
USSR	M Choporova, V Goryainov, G Il'ina, L Logakhina, A Lozhkina, D Rumyantsev, E Semenyuk, V Venda, V Voynenko, G Zarakovskiy, V Zinchenko

Section 3 The Organs of Management

Czechoslovakia	M Klivar, I Krulig
USSR	I Doroshenko, E Semenyuk, I Sidorova, A Strokina, V Voynenko

Section 4 Production Medium

Czechoslovakia	M Bauer, M Klivar, V Kodat, A Zeleny
GDR	M Rentsch
USSR	I Baron, E Bizunova, V Danilyak, V Isakov, Y Lapin, V Medvedev, V Munipov, V Soldatov, Y Solov'ev, P Turzin, A Ustinov

Contributors to Ergonomics: Principles and Recommendations
(cont)

Section 5. Principles of Organizing Work for the
Handicapped

Bulgaria S Mustafov

USSR V Zinchenko

Chapter 4. Ergonomic Bases of Man-Machine System Exploitation

GDR V Chakker, F Macher

USSR V Bodrov, S Faustov, T Garaseva, I Il'yasov,
Z Kalashnikova, S Khisambeev, A Kholmogopoba,
V Lidova, O Mal'tseva, A Narinskaya,
V Rayshito, K Smirnov, S Sosnovckaya,
V Tkhorevskiy, K Uoseliani, V Voynenko,
V Zaretskiy

Chapter 5. Ergonomic bases of Standardization and Evaluation of
Industrial Production Quality

Section 1. Standardization of Ergonomic Norms and
Demands

Bulgaria V Kutsarova

Poland J Slowikowski, I Snopcinski

USSR V Danilyak, V Munipov, V Oshe

Section 2. Ergonomic Evaluation of the Quality of
Production

Bulgaria K Brankov, N Gradinarov, S Gurdzheva,
K Kyncheva

GDR M Chmela, P Rittmuller

Hungary L Bartha

Poland E Gales, J Gerasimink, K Janiszewski,
B Kwiatkowski, L Pacholski, L Poliuszkewicz,
P Szwedinski, K Wiszniakowski

USSR E Buyanova, V Danilyak, V Munipov,
R Pozdnyakova

II. CEMA Efforts to Develop Ergonomics Databanks

1. A 1975 agreement among the CEMA countries identified nine common interests in ergonomics research:
 - (1) ergonomics theory and methods;
 - (2) ergonomics criteria;
 - (3) unified research methods and apparatus to obtain a common and directly comparable database for all countries leading to an ergonomics databank;
 - (4) standardization in ergonomic evaluations and design approaches;
 - (5) automation in industry;
 - (6) information delivery systems;
 - (7) organization of men to manage and control equipment systems incorporating skill levels, training, and number of operators;
 - (8) handicapped operators and abilities and limitations of the aged; and
 - (9) economic considerations, e.g. trade-offs between safety and/or ergonomics and associated cost factors.

Notice that the third research area calls for common and directly comparable data sets leading to an ergonomics databank. (S.L. Seminara, 1979).

2. Scientists and other professionals of the CEMA member-countries have started to define general principles for setting up a functioning bank of ergonomics data. (V.L. Munipov, 1984). Four principles set forth are:
 - (1) working out the scientific bases of standardization in ergonomics;
 - (2) normative descriptions of the research and development activities of the ergonomist;
 - (3) definition of the general principles and procedures for the standardization of ergonomics norms and requirements, as well as the preparation of ergonomics standards;
 - (4) research into social and economic efficiency resulting from the implementation of ergonomics achievements in the national economy.
3. Anthropometric atlases of the populations of Bulgaria, Poland, the Soviet Union and Czechoslovakia have been compiled and published for designers of industrial products and equipment for workplaces. Recommended methods and measurement programs were used in the collection and unification of data to facilitate transfer of anthropometric standards, e.g. recommended work space envelope based on uniform measures of sitting height, reach, and eye level.

II. CEMA Efforts to Develop Ergonomics Databanks (cont)

Two of these four anthropometric atlases have been identified in libraries in the United States: Anthropometric Atlas: Recommendations on Methods, A.N. Strokina, Editor-in-Chief, VNIITE, Moscow, 1977, (Translated from Russian by the Amerind Publishing Co., New Delhi, India, in 1985) provides anthropometric data on Armenian, Russian and Lithuanian men and women and on various Russian professional and age groups; and Anthropologic-Ergonomic Characterization of the Bulgarian Population, Stefan S. Mutafov, Bulgarskata akademiia na nauki, 1985. The Library of Congress has the Bulgarian atlas, but doesn't circulate it.

4. Professor Slowikowski, at the Institute of Industrial Design, Warsaw, is cooperating with the Center for Industrial Design in Sofia, Bulgaria to study the effects of hypokinesia (reduced motion) on performance. One goal is to determine the optimal motion loading for seated work. Five degrees of worker motion were established:
 - (1) zero motion of seated operator for eight continuous hours,
 - (2) fixed body seated with only wrist and finger motion,
 - (3) fixed seated body with motion of the elbows, wrists, and fingers,
 - (4) seated subject with movement of the shoulders, wrists, and fingers permitted, and
 - (5) seated subject with torso side-to-side motion required. (J.L. Seminara, 1976).
5. The Central Institute of Occupational Medicine in Berlin has co-operative relationships with similar organizations in each of the East European Socialist countries plus Cuba, the USSR, Finland and Yugoslavia. Coordination meetings are held periodically to negotiate areas of research responsibilities. The German Democratic Republic has the responsibility for coordinating all physical environmental standards.
6. The Central Institute of Labor in Dresden serves as the national center for information regarding industrial safety. A subgroup deals with international relations and follows International Labor Organization (ILO) activities. The GDR has cooperative agreements with other socialist countries in the area of noise protection.
7. The Laboratory of Psychology at the Technical University of Budapest, headed by Lajos Bartha, is responsible for examining the basic ergonomic principles and guidelines in the formation of international ergonomic standards for CEMA. Prof. Bartha hopes for closer East-West ties regarding ergonomics research.

III. International Databank Network

A telephone line between the Electric Power Industry Research Institute (VEIKI) in Budapest and VNIITI, the largest scientific and technical information center of the Soviet Union, was established in March, 1985. This linked Hungary into the computerized information network of the CEMA countries.

Through the VEIKI Hungary can access the databases of Socialist countries which were earlier linked up with VNIITI, including data files which can be queried online in Bulgaria, Czechoslovakia and the GDR. Through the packet switching net between Moscow and Helsinki, Hungary can access the data network of Finland, and through Finland some Western data service centers as well. (Gitta Takasc, "Data Transmission Link Between Budapest and Moscow; Online Information Querying", Szamitastechnika, in Hungarian, May 1985, JPRS-ESA-85-024, 7 August, 1985).

Informatik, a German Democratic Republic journal, described the information network of the facilities of the USSR Academy of Sciences as making a major contribution to the development of the SASWTI (State Automated System for Scientific-Technical Information). The network provides the user with information contained in the databases of individual research centers. (D. Keil, Informatik, in German, Vol. 31, No., 6, 1-5, JPRS-TTP-85-006, 26 February, 1985, "Commentary on Start of Scientific Data Transmissions With USSR, East Berlin.")

IV. Survey of East European Ergonomics

J.L. Seminara conducted a survey of East European ergonomics from 1975 to 1984. When contacted by phone for this review, Seminara said that his study on ergonomics was the only survey by a Western scientist. The countries and dates of the Seminara surveys are: Bulgaria, 1974 and 1982; Romania, 1975; Poland, 1979; Czechoslovakia, 1979; the USSR, 1979 and 1980; Hungary, 1980; and the German Democratic Republic, 1984.

BULGARIA

J.L. Seminara visited Bulgaria in 1974, and conducted a five-month survey on the status of human factors (J.L. Seminara, "Human Factors in Bulgaria," Human Factors, 1976, Vol. 18, No. 1, 33-44). He visited Sofia for ten days in 1980 to examine changes that had occurred since his 1974 visit (J.L. Seminara, "Bulgarian Ergonomics Revisited," Applied Ergonomics, 1980, Vol. 31, No. 1, 43-48).

National Council of Ergonomy

The National Council of Ergonomy, headed by Prof. N. Boshev, is a large network of national, regional, and plant councils involving about 4000 individuals. The Council sponsors a Journal of Ergonomics, coordinates meetings with other countries, organizes conferences on ergonomics within Bulgaria, and promotes training programs in ergonomics. There are about 30 regional Councils of Ergonomy in Bulgaria. (Seminara, 1976).

In 1980 a system of national, regional and local plant councils of ergonomics was in place and assuming increasing importance. Members of the plant Ergonomics Councils have considerable power. If ergonomic norms are violated that endanger workers, the councils can shut down the plant.

Plovdiv Regional Council

The Plovdiv Regional Council of Ergonomy and Industry was the first regional council, founded in 1966 through the efforts of trade unions and researchers in work physiology and industrial hygiene. (Seminara, 1976). The regional council provides educational programs in ergonomics. Engineers and trade union inspectors can take a one-month course in ergonomics followed by on-the-job practical work. A three volume text (unspecified) has been assembled dealing with physiological and psychological norms and standards pertaining to ergonomics.

BULGARIA (cont)

Laboratory of Psychology, Sofia

The Laboratory of Psychology, Sofia, is directed by Z. Ivanova, and has 20 staff members. The laboratory is divided into four sections: Psychology of Personality, Social Psychology, Experimental Psychology, and Work Psychology. Each section offers courses in its specialties.

Psychology of Personality Section

The Psychology of Personality Section is concerned with such topics as personality and social environment, scientific creativity and motivational factors, and motivation and level of aspiration.

Social Psychology Section

The Social Psychology Section deals with such topics as leadership, competition, goal actualization in work situations, rewards, and aggressive behavior in competitive work situations.

Experimental Psychology Section

The Experimental Psychology Section basically supports other sections in such areas as experimental design, statistics, and computer applications.

Work (or Industrial) Psychology Section

Major research themes in the Work Psychology Section are examination of psychological states in the work process, and the adaptation of young workers to new jobs.

BULGARIA (cont)

Department of Physiology of Work, Institute of Hygiene, Sofia

The Department of Physiology of Work, in the Institute of Hygiene, acquired new equipment in 1980 through the United Nations. All the data accumulated by the Department are now computer compatible. The Department consists of three laboratories and one group:

Functional Laboratory of Physical Factors;
Laboratory of Applied Neurophysiology and Psychophysiology;
Laboratory of Adaptation, Work Capacity and Fatigue;
Group for Extreme Stress.

The Institute of Hygiene has developed a data gathering form used in Bulgarian factories for recording the following information:

- (1) Physical Work Loading
energy expenditure, lifting or carrying heavy objects, work posture;
- (2) Mental Loading
pace of work, monotony, psychomotor tasks, psychosensory tasks, auditory stress, attention, emotional stress, responsibility;
- (3) Work Schedule
duration of work day, work-rest regimen, work breaks, duration of work week;
- (4) Ergonomics Checklist
work station design, seating design, design of industrial machinery, eq. display coding, control actuation force requirements, arrangement of controls.

Georgy Dimitrov Higher Institute of Physical Culture

Researchers at the Institute examine the emotional makeup and incentives of individuals choosing a particular sport, the collective behavior of teams in such sports as basketball and football, unwinding techniques subsequent to sports competitions, and the selection of young potential athletes in different sports categories.

CZECHOSLOVAKIA

Information in this section comes from Seminara's three-week visit to Czechoslovakia in 1978, (J.L. Seminara, "A Survey of ergonomics in Czechoslovakia, Applied Ergonomics, 1979, Vol. 10, No. 3, 155-163).

Seminara was unable to determine the exact number and type of scientists engaged in ergonomics activities in Czechoslovakia. There are about 50 members in the Society for Ergonomics in Bratislava. There is also a Society for Ergonomics in Prague headed by Adolf Zeleny. The best estimate obtained was that there are about 200 researchers in ergonomics in all of Czechoslovakia. There is no one journal devoted to ergonomics.

The journal Studia Psychologica, devoted to basic research in psychology, was being edited by Damian Kovac, Director of the Institute of Experimental Psychology at the Slovak Academy of Sciences.

Ergonomics was not strongly supported by Government, the Academy of Science, industry or the trade unions. However, ergonomic work in the area of forestry machines was well funded, and has a long tradition. Comparable efforts probably will be extended to other industries, especially the aircraft industry.

Researchers in ergonomics had no clear idea of overall ergonomic developments in Czechoslovakia and some were not aware that their neighbour, Poland, was sponsoring an international gathering of ergonomists. There were no current plans for educational programs to train ergonomists; but the Technical University in Prague was planning to include human factors components in some engineering courses.

CZECHOSLOVAKIA (cont)

Department of Ergonomy, University of Agriculture and Forestry, Brno

The Department of Ergonomy in the University of Agriculture and Forestry addresses problems of professional neuroses, noise, vibration and exhaust gas. The University has contracts with design organizations to review forestry machines for ergonomic considerations.

The Department of Ergonomy consists of two physiologists, one engineer, one psychologist and three technicians. Ergonomics in this field is largely considered the province of forestry engineers and medical doctors or physiologists from the Faculty of Medicine. There is a tendency to use interdisciplinary teams in studying specific problems.

Some of the research topics included under the heading Human Factors in Forestry Management are:

- Ergonomy of logging;
- Ergonomy of thinning young forests;
- Ergonomy of reforestation;
- Motivational factors for labor;
- Safety in logging and transportation;
- Occupational diseases caused by new types of equipment, eg. chain saws;
- Professional development of labor in forest management; and
- Social and working conditions for forestry workers.

Technical University, Prague

Ergonomics has been perceived as important for the aircraft industry. Jaromir Schindler, professor of aeronautical engineering at the Technical University includes a large human factors component in his courses on reliability for the aircraft industry. Similarly, such special courses are being developed for the Technical University students. Seminara noted that anthropometric differences among producers and clients create some problem in the aircraft industry, which exports most of its products. The Chinese, Korean and Vietnamese pilots are much smaller than the Czechoslovakian norms.

CZECHOSLOVAKIA (cont)

Czechoslovakian Test Stations

There are over 40 State Test Stations in Czechoslovakia which evaluate industrial and agriculture machines, as well as a variety of consumer goods, according to established norms and regulations.

The three main activities of these stations are:

- (1) inspection, evaluation and approval of products in use;
- (2) inspection, evaluation and approval of new products;
- (3) special technical service and support to manufacturing organizations, eg. ergonomic measurements.

Ergonomic measurements are the responsibility of engineers attached to the Test Station. These engineers were not trained as ergonomists since no baccalaureate educational program exists. They have received post-graduate training in ergonomics provided by the Technical University in Prague.

Institute of Hygiene, Bratislava

The Institute of Hygiene in Bratislava contains a Physiology Department which focuses on ergonomic problems. Miroslav Hubac heads this organization and is president of the Slovak Ergonomics Society. The Forestry University in Bratislava has ergonomics interests comparable with those reviewed at the University of Agriculture and Forestry in Brno.

Institute of Experimental Psychology, Slovak Academy of Sciences, Bratislava

Damian Kovac heads the 40-member Institute, which is divided into five departments: General Psychology, Personality, Psychophysiology, Engineering Psychology and Man Modeling. Seminara visited only the Department of Engineering Psychology.

Department of Engineering Psychology

The Department of Engineering Psychology, headed by Jozef Daniel, has four psychologists and one technician who research mental load issues and stress. The designs of machine systems, some of which are from Great Britain and Japan, have been reviewed for ergonomic considerations, i.e. vigilance, short-term memory of operators, and time stress factors. Research focuses on the needs and interests of local industry. Daniel wrote a book in 1975 titled: Psychological analysis of operator activities.

CZECHOSLOVAKIA (cont)

Ergonomics Department, Occupational Safety Research Institute,
Prague

The Ergonomics Department of the Occupational Safety Research Institute is staffed with 16 people, four psychologists, three engineers, two medical doctors, one industrial designer and six laboratory assistants. Interdisciplinary teams attack special problems so that different perspectives can be applied to solutions. Much of the research undertaken by the Ergonomics Department is stimulated by manpower shortages that appear in certain occupations, such as mining.

Department of Ergonomics in the Research Institute of Fuel and
Energy Economics, Prague

The Department of Ergonomics in the Research Institute of Fuel and Energy Economics investigates theoretical and practical problems of the relations among ergonomics, reliability and safety. The Institute has branches in Most, Sokolov, and Ostrava in addition to the headquarters branch in Prague. The Psychology Laboratory in the Institute is primarily involved with selection of workers. Selection criteria include:

- reaction time measure,
- pattern recognition,
- tracking tasks,
- depth perception, and
- written tests:

- Bennet Test of Mechanical Intelligence,
- Raven Progressive Matrix Test,
- Amthauer Structural Intelligence Test, and
- Wechsler Memory Test.

GERMAN DEMOCRATIC REPUBLIC

Information in this section comes from Seminara's two-month visit to the German Democratic Republic in 1982. (J.L. Seminara, "Ergonomics in the German Democratic Republic," Applied Ergonomics, 1984, Vol. 15, No. 3, 215-227).

Until the mid-1960s, each discipline in the German Democratic Republic related to ergonomics in its own isolated fashion. In 1966, Professor H. Kulka founded a five-year academic training program to train ergonomists at the Karl Marx State Technical University. It was designed for engineering students specializing in ergonomics. The program was a mix of mechanical engineering (70%) and ergonomics (30%). About 150 students graduated between 1966 and 1973 and the program was generally seen as a success.

A 1975 national law, "Directive on the application of scientific work organization," dealt with three aspects of work performance:

- (1) optimization of workload,
- (2) promotion of worker job satisfaction, work ethics and job enrichment,
- (3) maximization of productivity.

Seminara stated that the 1975 law is seen as providing the major impetus for ensuring that ergonomics requirements are met in factories.

Professor Kulka has tried without success to establish an ergonomics society in the GDR. There is no representation by the GDR in the International Ergonomics Association, nor is there one central journal of ergonomics. Kulka published a book in 1980 titled Why Ergonomics? Seminara stated that Professor Kulka could be regarded as the "father of ergonomics" in the GDR.

Ergonomics Ministries

Although each of the more than twenty government ministries has a Work Sciences Group covering ergonomics there are three ministries that are especially responsible for ergonomics:

- Ministry of Health,
- Ministry of Labor and Salaries, and
- Ministry of Industrial Design (not described by Seminara)

GERMAN DEMOCRATIC REPUBLIC (cont)

Ministry of Health

The Ministry of Health encompasses the Central Institute of Occupational Medicine, Berlin. Wolfgang Bachmann is Acting Director of the 400-member organization, which has three main departments: Occupational Hygiene, Occupational Physiology and Psychology, and Clinical Occupational Medicine.

Central Institute of Occupational Medicine, Berlin

Seminara described work at the Institute overall rather than dealing singly with each of the three departments. Because occupational medicine is regarded as part of ergonomics, work is examined from the standpoint of "ergonomics load" both physical and neurological.

The Institute isn't directly involved with design of workplaces but gives advice to design organizations upon their request. Special forms called "Professiograms" have been developed by the Institute for analysis of all jobs.

The Professiograms allow physicians located at industrial sites to record noise levels, vibration exposures, environmental contaminants, accident causes, history of occupational diseases, etc. The data are used for many purposes, including ergonomic evaluation of workplaces, vocational guidance, and determining special pension or incentive pay requirements.

The Institute is developing special test facilities for studying whole body vibration, to be used for study of seat design factors.

The Institute conducts special studies of adverse working conditions when they are reported to them, such as thermal stress in miners. From 1982-84 the Institute examined working conditions in the automobile industry.

Psychologists work on job analysis and design, training issues, and enhancing worker fitness. They are also involved in developing standards relating to whole body vibration limits, psychological correlates of environmental stressors, effects of toxic agents on man, and job studies involving 'stress and strain' analysis.

GERMAN DEMOCRATIC REPUBLIC (cont)

Ministry of Labor and Salaries

The Ministry of Labor and Salaries includes the Central Institute of Labor and the Central Institute of Labor Protection (Safety).

Central Institute of Labor

The Central Institute of Labor, in Dresden, is headed by Heinz Hanspach. Functions of the Institute include: (1) Preparing guidelines for factory managers with respect to wages, based on analyses of different categories of work; (2) Focusing on methods for optimum grouping of people in work organizations and distribution of worker skills across the entire economy.

The Institute develops special training programs for factory managers. Seminara mentioned two films produced by the Institute, describing them as good examples of ergonomics activities in the GDR.

The first film, about the development of a harvester/combine, uses interviews with operators, design of replacement parts, shows how a detection system operates, depicts measurement forces required to operate vehicle controls and shows how the operator's seat was redesigned to lessen vibrations. The film also showed how a special van, equipped with instruments, was used for field testing prototypes.

The second film deals with methods and efforts to humanize work, depicting four case studies for illustration. The case studies dealt with automation, job rotation, group participation in production to replace dull assembly line work, and worker organization of the work process. Worker motivation is seen as an important Institute task. The Institute employs industrial engineers and industrial psychologists.

GERMAN DEMOCRATIC REPUBLIC (cont)

Central Institute of Labor Protection (Safety)

The Central Institute of Labor Protection (Safety), directed by H. Rehtanz, serves as the national center for information regarding industrial safety. A subgroup deals with international relations and follows International Labor Organization (ILO) activities.

Although having no formal ergonomics program or staff, the Institute researches such areas as labor safety through safety standards, training programs for management and workers, and protection measures against noise, vibration, toxic elements and contaminants.

Center for Labor Safety in the Building Construction Industry,
Berlin

The Center for Labor Safety in the Building Construction Industry, Berlin, has activities similar to those of the Central Institute of Labor Protection in Dresden, but specific to the building construction industry. The center develops prototype worker protection equipment and then assigns those to an appropriate industrial enterprise for production.

General activities include standards development and safety research covering accident analyses and statistics, construction work flow processes, and construction equipment and techniques.

The center publishes a work safety journal which features the results of ergonomics and industrial hygiene research relating to the construction industry. The psychologists associated with this center are mainly involved with training functions.

A comparable labor safety center in Halle specifically focuses on the chemical industry.

Technical University of Dresden (TUD)

The 150-year-old TUD has 12,000 students training to become engineers, physicists or workers in other scientific and technical activities. The TUD is the main institution in the GDR for an education in Work Sciences.

GERMAN DEMOCRATIC REPUBLIC (cont)

Work Sciences Department

The department, headed by Professor Kurt Volker, has 130 staff members. All engineering and economics students are trained in Work Sciences. The Work Sciences Department has five subsections:

- Institute of Psychology
- Institute of Physiology
- Institute of Industrial Engineering
- Institute of Theory and Methods of Work Sciences
- Institute of Industrial Economics (Not visited by Seminara)

Institute of Psychology

The Institute of Psychology, headed by Winfried Hacker, focuses mainly on industrial psychology and its applications oriented. Some graduates of the Institute are attached to medical service stations located at factories with more than 3000 employees. These industrial psychologists conduct job analyses and job design activities, and gather workload, fatigue and stress measurements. Other graduates work in training or within the approximately 200 vocational guidance centers in the GDR.

Research activities examine various aspects of the work setting including monotony, boredom, anxiety, mental fatigue, mental processes used in specific work activities, skills development, and measurement of positive attributes of work.

Institute of Physiology

The Institute of Physiology is headed by Professor Dettmar, and provides academic training in physiology related to ergonomics or work sciences. The Institute does not train physiologists but provides course work to students training in industrial engineering, psychology and economics. Main research interests relate to mental stress as indicated by brain potential measurements, which are believed to depict mental load better than such traditional measures as heart rate, metabolic measures, respiration rate, etc. Researchers are investigating improvement of evoked potential measurements so as to extract useful information from a single evoked potential (EP).

GERMAN DEMOCRATIC REPUBLIC (cont)

Institute of Industrial Engineering

The Institute of Industrial Engineering is headed by Professor M. Rentzsch. Three groups, work environment, work safety, and work processes, carry out research programs in areas such as temperature, noise and vibration, manufacturing processes, anthropometry, eye and hand movements, and task posture dimensions.

Institute of Theory and Methods of Work Sciences

The Institute of Theory and Methods of Work Sciences is headed by Fritz Macher. It offers courses in "scientific organization of work" including labor safety, techniques for optimizing assembly of men and machines in work situations, ergonomics, etc. The central research theme in the Institute is the automation of work in the socialist economy, developing criteria for selecting workplaces most suited to robotic applications. The Institute has developed checklists to evaluate workplaces with such criteria as temperatures, contaminants, hazardous conditions, monotony and noise. The University offers special courses for factory representatives on the application of checklists and robotic suitability evaluation methods.

Psychology Section, Humboldt University, Berlin

The Psychology Section at Humboldt University, Berlin, trains students specializing in industrial and engineering psychology. Seminara noted that emphasis in engineering psychology has declined because psychologists are rarely consulted in early design stages.

Research interests of faculty and students include job design, vocational training and information display design. Seminara felt that there would be more attention to the man/computer interface with research aimed at video display formatting, coding and use of color. Research applications would be used for control functions in power generation and chemical process industries, and management information systems. Visual information processing for design of road signs has been a research activity of the Psychology Section also.

GERMAN DEMOCRATIC REPUBLIC (cont)

Karl Marx University, Leipzig

Karl Marx University at Leipzig trains doctors for specialization in fields of occupational medicine such as industrial hygiene, industrial physiology and industrial toxicology.

Department of Industrial Hygiene, Karl Marx University

The Department of Industrial Hygiene, headed by Professor E. Springer, researches the relationship between anthropometric features of workplaces and occupational diseases. Extensive investigations are being carried out relating to work stress with one goal being to improve methods for selecting people for high-stress work and finding better techniques for coping with stress.

Industrial Design Board, (AIF)

The Board is headquartered in Berlin. Different branches in other parts of the country specialize in different product categories. The branches review products of the GDR against national standards that include such ergonomic considerations as anthropometrics of seated and standing workplaces, visual fields, lighting, noise, vibration limits and placement of controls.

Department for Work Environment Design, Dresden, Industrial Design Board, (AIF)

A multidisciplinary "ergonomics" group is affiliated with the Dresden agency, and is comprised of architects, industrial engineers, measurement engineers and psychologists. The ergonomics group serves as the research arm of the AIF. It also serves in a consultant role with small manufacturing companies.

HUNGARY

Seminara's five-week visit to Hungary in 1980 explored the current status of ergonomics, its historical development, and projected future directions, (J.L. Seminara, Applied Ergonomics, 1980, Vol. 11, No. 4, 207-221).

All of the larger factories in Hungary have work psychology or ergonomics laboratories. Seminara said that psychologists predominantly populate Human Factors laboratories. Physiologists in Hungary have had, to date, very little involvement in ergonomics. Most applications of ergonomics appeared to Seminara to be on a remedial basis rather than during the initial design phase.

The feeling of psychologists at one psychology laboratory is that too many psychologists in Hungary are working in applied areas with insufficient attention given to basic research needs. Seminara found that there was considerable interest in the "new field" of ergonomics. A national ergonomics conference in 1978 drew over 800 delegates.

Industrial Design Department,
Hungarian Academy of Arts, Crafts and Design

This is the only school in Hungary for industrial designers. The Industrial Design Department offers 52 hours of ergonomic-related classes out of a total of 4684 hours for nine semesters in the academic program for industrial designers. Ergonomists in Hungary deal with traditional psychological problems rather than design of products. Most (60%) of the industrial design work is done freelance, resulting in higher wages and more personal freedom for those industrial designers. The department enters into special arrangements with industrial organizations to perform work on a contract basis for the power industry.

HUNGARY (cont)

National Institute of Occupational Health, Budapest

The National Institute, located in Budapest, is comprised of the Laboratory of Work Psychology, the Departments of Experimental and Applied Physiology, and the Noise and Vibration Laboratory.

Laboratory of Work Psychology

The Institute's Laboratory of Work Psychology, headed by Tibor Hodos, has been primarily concerned with accident investigation. A more recent interest is studying the incidence and causes of neuroses among various categories of workers. The newest research theme is control room design, specifically, the human factors aspects of energy dispatch centers and power plant control rooms.

Departments of Experimental and Applied Physiology

The twelve member Department of Experimental Physiology is headed by Andor Erdelyi. Attila Mitsanyi is chief of the eight member Department of Applied Physiology. Physiologists in the departments were working with Tibor Hodos on a textbook, Man-Stress-Strain. Psychologists and physiologists cooperated on preparing a chapter for the Textbook of Occupational Health, scheduled for publication in 1980. Staff members of the two departments perform education-related activities in association with the neighboring medical school.

Noise and Vibration Laboratory

Research in the Noise and Vibration Laboratory has dealt with adverse effects on hands and arms from tool vibration. Laboratory staff consult with factory resident medical doctors about vibration problems. This laboratory also tracks field experience with different vibration levels over time to note the incidence of impairments, so as to contribute to evaluation of ISO standards.

HUNGARY (cont)

The National Energy Dispatch Control Center, Budapest

This control center in Hungary is integrated in a network with six CEMA countries. Seminara alluded to but did not specify a four-volume Russian study containing selection criteria for dispatch operators. Tibor Hodos, of the Laboratory of Work Psychology, National Institute of Occupational Health, and his staff are examining various aspects of control rooms:

- (1) man/computer-based display relationships,
- (2) optimal display configurations to provide insights into processes,
- (3) methods for best alerting operators to changes in process states,
- (4) vigilance and work/rest cycle factors, and
- (5) control board arrangement factors.

Work Psychology Laboratory, Cespel Iron and Metalworks, Budapest

Personnel selection is the primary activity of the Work Psychology Laboratory, headed by Jeno Dulin. Laboratory staff make assessments regarding required abilities, skills and personality traits based on their first-hand observations of tools, work activities, workplace, environment, organizational factors, machines, and products of labor. The staff then devises appropriate paper and pencil tests and special laboratory instruments to be used in selection screening.

Psychology Laboratory within the Commerce and Catering Trade (KEROG), Budapest

This department develops examinations for students in the catering trades, and examines problems associated with the loss of individuality in assembly line production, group motivation and morale factors. One of the more interesting projects, Seminara noted, was developing selection criteria and tests for gambling casino croupiers.

HUNGARY (cont)

Psychology Department, Technical University of Budapest

The Technical University has a broad program of education in civil engineering, architecture and mechanical engineering. The Psychology Department, headed by Lajos Bartha, offers general courses for engineering students and future teachers in developmental, general, educational and work psychology. Course offerings in work psychology include elements of ergonomics. Professor Bartha hopes that ergonomics will be taught routinely to all engineering students in the same way that anatomy is taught to medical students. The Psychology Department offers a two year postgraduate course in ergonomics for engineering students and also was developing a postgraduate course in ergonomics for psychologists during Seminara's visit.

Scientific Research Institute for Labor Safety of the Central Council of Hungarian Trade Unions, Budapest

The Institute carries out basic and applied research to control accident sources and prevent health problems among Hungarian workers. Professor Imre Scheuring, Deputy Director of the Institute, responded to our information request and said that there are five databases of the following contents which are available on IBM-compatible diskettes:

- Hungarian patents,
- Legislation,
- Standards,
- Innovations in connection with occupational safety, and
- Homologated personal protective devices in Hungary.

The Ergonomics Research Group, located in the Institute's Department of Work Safety, looks at stress factors in diverse work situations and develops recommendations for improvements as needed. Stress factors examined include:

- Time pressures,
- Machine deficiencies,
- Psychological stress,
- Teamwork,
- Organizational structure,
- Incentives, and
- Factors that may lead to psychoneuroses.

Some of the methods and instruments used for data-gathering include:

- Questionnaires,
- Telemetric methods with bioinstrumented workers,
- Job analyses, and
- Analyses of social and financial factors.

HUNGARY (cont)

Institute of Labor Research,
Ministry of Labor and Salaries, Budapest

The Institute of Labor Research has 80 staff members, with six members in the Department of Psychology. The Ergonomics Research Group has been recently formed with the Institute of Labor Research, with one of its goals the establishment of a comprehensive ergonomics data system to answer the needs of engineers, e.g. optimum chair design, work-rest cycles, etc.

Institute for Psychology, Budapest

The Institute, directed by Ferenc Pataki, has 100 people in six departments:

- (1) Social Psychology,
- (2) General and Comparative Psychology,
- (3) Psychophysiology and Psychopathology,
- (4) Educational Psychology,
- (5) Developmental Psychology, and
- (6) Personality (not described by Seminara)

Department of Social Psychology

This department researches decision-making in complex organizations. Seminara noted that decision-making is more complex in Hungary than in most Western nations because the whole country operates as one large centralized firm, compared with the decentralized institutions and enterprises in capitalist countries. Special attention has been devoted to:

- (1) Questions of uncertainty in decision-making,
- (2) Resolving problems of conflicting goals within an organization,
- (3) Risk-taking, and
- (4) Information.

HUNGARY (cont)

Department of General and Comparative Psychology

This department has been involved in researching animal and human processing of visual and acoustic information. Other research examines brain wave changes associated with learning. A changed pattern of evoked potentials has been observed before and after subjects learned to recognize three amorphous "antler" type visual stimulus configurations. Comparisons are also being made between monkey and human brain hemispheric asymmetry. Much of the work of this department requires computer processing of brain wave data. There was a concern that a lack of computer capability would hinder further research in this area.

Department of Psychophysiology and Psychopathology

This department, headed by George Kamos, is attempting to close the gap between psychological and physiological approaches. Sensory processes, mainly auditory, are being examined by means of evoked potential and behavioral experiments. The department has a well-equipped laboratory available for animal work, which was studying cats' responses to auditory stimuli. The responses were videorecorded, with a split screen for noting time in tenths of a second. The visual record was then matched against recordings of physiological measures.

Educational Psychology Department

Areas of research in this department include the idea of self, motivational aspects of education, and creativity. Researcher Margit Devai Kiraly examines the idea of self among 10-14 year-old students, looking for discrepancies between the ideal and the real self in terms of IQ, social adaptation, and achievements. This research leads to recommendations for schools. Bela Kozeki researches how a student's relationships with parents, teachers and peer group build his motivational profile. Kozeki describes the motivational profile as three dimensional: (1) interpersonal relationships extending from a feeling of belonging to isolation; (2) autonomy vs. rigid conformity; and (3) morality norms. Researcher Agnes Deak has examined creativity by administering creativity tests to students, then correlating teacher estimates of student creativity with test results. Deak found low correlation between teacher judgements of creativity and test measures of creativity.

HUNGARY (cont)

Developmental Psychology Department

This department includes the Psychosocial Group and the Psycholinguistics Group. The Psychosocial Group deals with internalization of social norms, masculine-feminine roles, aggression, altruism and deviant behavior. The Psycholinguistic Group conducts research in early verbal development of children from ages two months to two years, or to development of the first sentences. This group also examines the effects of bilingual home environments (e.g. Russian and Hungarian) in terms of possible interferences in speech development. Further research in this area will include acoustic analyses of recordings made of children's vocalizations in free play situations.

Department of Personality

Laszlo Garai, head of the department, was unable to visit at length with Seminara, though he described work in his department in a paper titled: "Towards a Social Psychology of Personality: Development and Current Perspectives of a School of Social Psychology in Hungary," (Social Science Information, 1979, Vol. 18, No. 1). Seminara said that he did not understand the paper.

POLAND

Information on Poland comes from J.L. Seminara's three-week visit in July 1978 under the sponsorship of the National Academy of Sciences' scientific exchange program. (J.L. Seminara, "A Survey of Ergonomics in Poland," Ergonomics, 1979a, Vol. 22, No. 5, 479-505).

The demand for industrial psychologists was not being met in 1978, since most students preferred clinical psychology. There were only about 100 engineering psychologists in Poland.

Central Institute for Labor Protection, Warsaw

The three departments most closely identified with ergonomics are:
Engineering Psychology,
Physiology and Work Hygiene, and
Acoustics

Engineering Psychology Department

The Engineering Psychology Department focuses on the design of agricultural and construction equipment and has three engineers and five psychologists. Research at this department includes: job analyses, potential for accidents, observations of operators in operational settings, biomechanic studies, operator interviews, measures of heart rate, reaction times, dynamometer strength readings before, during and after work, and audiometric threshold tests.

Specific projects of the department include:

- (1) Development of color standards for industry;
- (2) Illumination standards based on visual fatigue studies with different forms and levels of illumination;
- (3) Legibility of different types of displays, e.g. Light Emitting Diodes;
- (4) Relationship between monotonous work and worker personality variables;
- (5) Safety protection for pressing machines; and
- (6) Ergonomic problems in the printing industry.

POLAND (cont)

Department of Physiology and Work Hygiene

The Department of Physiology and Work Hygiene within the Central Institute for Labor Protection is concerned with environmental impacts on human work conditions, including detrimental effects of vibration in certain job tasks. An orthopedic surgeon attached to the department is establishing strength profiles for different segments of the hand to guide the shaping of handles for air-driven sanders. Dynamometer-like devices have been used to map hand strength in different orientations of sander use-- overhead, laterally, and pressing down.

Acoustics Department

Research at the Acoustics Department, headed by Czeslaw Puzyna, deals with ear protection requirements and devices. Staff have conducted speech intelligibility studies on workers wearing different ear protection devices. They also have conducted noise attenuation tests on alternative types of ear protection devices, including those of U.S.A. design. The work leads to noise standards which become national regulations imposed on industries. The department also develops methods for evaluating equipment that generates noise. Puzyna wrote Fighting Noise in Industry, published in 1974.

Institute of Industrial Design, Warsaw

The Institute of Industrial Design has about 300 staff members. Seminara visited the Anthropometry Laboratory in the Institute's Department of Ergonomics. Personnel from other departments were unavailable, due to vacation schedules in July.

POLAND (cont)Department of Ergonomics

The Department of Ergonomics is headed by an engineer, Jerzy Slowikowski. The Department has thirteen members in addition to the chief: two anthropologists, one psychologist, one medical practitioner, three engineers, one mathematician and five technicians. The department has four laboratories: Anthropometry, Psychology, Physiology, and Apparatus Construction. Due to vacations scheduled during his visit, Seminara was unable to speak with any laboratory personnel other than the head of the Anthropometry Laboratory.

Anthropometry Laboratory

Design engineers at the Institute make specific requests for anthropometric data which the Anthropometry Laboratory attempts to satisfy. In addition, data from this laboratory are used as the basis for establishing national standards governing the design for all Polish products. Dynamic anthropometry is being used to help rehabilitate handicapped persons with ailments such as arthritis and paralysis. Special devices are used to measure the degree of impairment in terms of limb movement restrictions.

Department of Architecture, Polytechnic University of Warsaw

The department, headed by Director W. Parczewski, utilizes ergonomic specialists as consultants on some projects such as studying special needs of handicapped people. One faculty member, Z. Szparkowski, has written a book (unspecified) on human engineering applied to architecture. Professor Szparkowski is on a special committee in the Polish Academy of Sciences that deals with ergonomic training needs and programs.

POLAND (cont)

Polish Psychological Association (PPA), Warsaw

The PPA has four sections:

- (1) Clinical Psychology,
- (2) Educational Psychology,
- (3) Psychology of Labor, and
- (4) Military Psychology.

Dr. Ida Kurcz, President of the Association, said that about one-third of all psychologists are working in industrial fields, where there is considerable demand for them. Dr. Kurcz said that females (80%) make up the majority of those who choose psychology as a profession. The sections Psychology of Labor and Military Psychology have a larger number of males than other fields of psychology.

Institute of Psychology, University of Warsaw

Research at the Institute, headed by Professor Tomaszewski, includes clinical, educational and industrial psychology, as well as psycholinguistics. Seminara noted that the Institute would like to provide engineering psychology courses but there weren't specialists available for that purpose. The Institute researches motivational factors and attitudes towards work, rather than design of the workplace.

Institute of Psychology, Jagiellonian University, Cracow

The departments at the Institute include:

Clinical Psychology,
General Psychology,
Educational Psychology,
Psychology of Work, and
Psychology of the Handicapped.

Seminara said that a Department of Social Psychology would be added. About one-third of the 22-28 psychology graduate students major in Industrial Psychology, with about three of those students specializing in ergonomics. Masters degree thesis topics relating to ergonomics have included:

Analysis of a foundry control station panel;
Analysis of the control station for trains; and
Analysis of the cockpit for an agricultural airplane.

POLAND (cont)

Institute of Psychology, Jagiellonian University, Cracow
(cont)

Another ergonomics project conducted at the Institute by Zbigniew Zarczynski, reviewed the design of a present-generation locomotive control station. A labor shortage in Poland presented problems for locomotive operators who were faced with trying to singly operate British-built trains, designed for two operators. Zarczynski observed many design defects involving illumination, color codes, window design and temperature control. Other ergonomic-related research at the Institute includes:

- (1) Ergonomic considerations in the design of apartment houses,
- (2) The extent to which women can replace men in male-dominated fields,
- (3) Noise effects on information transfer and memory,
- (4) Pupil dilation as a correlate of fatigue,
- (5) Psychology of work for handicapped people,
- (6) Road design for a growing motoring population,
- (7) Work-rest cycles and optimum work shifts for night work in the metallurgical and mining industries,
- (8) Effects of shift rotations.

Although there was a national shortage of psychologists at the time of Seminara's visit, he learned that the number of university seats in psychology would be cut in half due to a national stress on technical sciences.

Laboratory of Physiology of Work and Ergonomics,
Department of Occupational Health,
Academy of Medicine, Cracow

The Laboratory of Physiology of Work and Ergonomics, at Cracow, headed by Andrew Oginski, falls under the Department of Occupational Health, which is part of the Academy of Medicine. Laboratory research includes analysis of various types of work, using such measurement techniques as:

- Telemetered pulse rate,
- Metabolic loads,
- Urine collection and analysis as an indication of stress and strain,
- Choice reaction times,
- Critical flicker fusion, and
- Subjective fatigue estimates on a nine-point scale.

Other research projects include: workstation design, truck driver compartment design, differences in stress and strain for operators of computer-controlled vs. conventional machines, and work/rest cycles.

POLAND (cont)

Industrial Design Faculty, Academy of Fine Arts, Cracow

The Industrial Design Faculty of the Academy of Fine Arts offers five-year training programs in industrial design, with specializations in one of four areas:

- Design of Machines,
- Methodology of Design,
- Visual Communications, and
- Industrial Colors.

Ergonomic topics covered include anthropometrics, environmental effects, and psychological and sociological impacts. The Academy trains designers who have some foundation in ergonomics, rather than ergonomists per se. Research projects include games for handicapped children, special problems of the handicapped, e.g. handicapped automobile drivers, and time studies of hand manipulation. Staff member Professor Adam Gedliczka developed a workspace modeling tool in 1977 constructed from cardboard and wood. By moving elements in and out, operators of different dimensions can contour the work space according to optimal reach limits.

There is a strong interest in anthropometric measurement devices and data-gathering. Much work has gone into establishing limits of reach for operators in both normal and extended positions. Fifth, fiftieth and ninety-fifth percentile data for the Polish population are being developed for the next edition of their anthropometric atlas. Professor Jerzy Slowikowski, at the Institute of Industrial Design, expects the atlas will be published in 1987. He also said that their data are sent to the ERGODATA center in Paris, and that their publications are available to everybody.

Department of Ergonomics, Polytechnical Institute,
Gdansk

Professor Ireneusz Durlik, Director of the Institute, responding to our inquiry letter said that the Department of Ergonomics was working on ergonomic system in ship design and noise and vibration characteristics of ships' superstructures.

ROMANIA

Seminara conducted his survey of ergonomics in Romania between September 1971 and February 1972, (J.L. Seminara, "Human Factors in Romania," Human Factors, 1975, Vol. 17, No. 5, 477-487).

Romania has no special educational programs that lead to a degree in ergonomics. Students of psychology at the University of Bucharest all take courses in work psychology over a 1 1/2 year period, with one course per semester. Students of engineering at polytechnic schools take courses in ergonomics.

Institute of Psychology, Bucharest

Robert Floru is Director of the Institute of Psychology, which has a large number of personnel engaged in human factors work. The Institute has constructed a general purpose simulator that will permit research studies of alternative control panel arrangements and test reactions to simulated fault indications on the subject's displays.

Work Psychology Section

The Work Psychology Section of the Institute of Psychology, headed by Constantin Botez, is providing human factors support to a variety of industries, including an electronics plant, where incidences of intense fatigue were linked with high employee turnover.

Other programs conducted within the Work Psychology Section include:

- (1) Studies of the use of computers in production facilities;
- (2) Alternative control/display arrangements for oil refinery and power generation control stations;
- (3) Mathematical modeling of control panel operator monitoring behavior;
- (4) Analyses of factors which enter into the operator's diagnostic capabilities in regard to system and subsystem failures;
- (5) Evaluation of engineering symbols used on drawings and control panels;
- (6) Human factors considerations in conveyor belt production assembly lines in the electronic and shoe industries.

ROMANIA (cont)Work Psychology Section
(cont)

The Work Psychology Section produced a text dealing with job selection and training. It examined job analysis, individual differences in skills, methods for investigating human capabilities, training programs, selection techniques, motivational factors, organizational factors, and environmental considerations. In 1967 the Work Psychology Section assembled a 455-page text, titled Psychology of Industrial Work. Covered topics mentioned by Seminara included:

- (1) Man/machine systems,
- (2) Development of work psychology,
- (3) Components of work activity,
- (4) Design of the work place,
- (5) Selection and training problems,
- (6) Training programs,
- (7) Psycho-social aspects of industrial work, and
- (8) Consumer psychology.

Industrial Applications of Ergonomics

Seminara made several field visits to industrial plants, where he found deviations from generally accepted human factors engineering design principles. Seminara did note that the discrepancies he found probably wouldn't be very different from those he would find in plants in the U.S.

Combinatul Chimic Fagaras

The ergonomics laboratory at the Combinatul Chimic Fagaras was involved with relationships between worker performance and worker environment. Specific areas mentioned by Seminara were:

- Spatial separation of related panels,
- Arrangement of displays,
- Color coding of annunciator lights, and
- Design of modular panels.

Galati Steel Plant

Seminara's visit to the Galati Steel Plant uncovered deficiencies in plant safety, illumination, plant maintenance, and work station design. Seminara noted that the control room for the management of electrical, thermal, gas, and water supplies was very well designed from an aesthetic and functional standpoint. The control room equipment was imported from Germany.

ROMANIA (cont)

History of Transportation

Seminara said that 20% of the psychologists in Romania are employed by the Ministry of Transportation, where railroads are the main concern, being the primary mode of transportation. The primary activities of psychologists at the Ministry involve selection and training of personnel.

Simulators are used for assessing the performance of railway engine drivers as well as for selection and training. An experimenter's console permits control of visual and auditory signals and recording of the subject's performance. The simulators proved so successful that plans were being made for exporting them.

Psychologists attached to the Ministry are also concerned with psychological contributors to accidents, such as stress, family factors, and fatigue.

USSR

Much of the material in this section came from Seminara's 1977 study of human factors in the USSR, conducted during a three month visit, (J.L. Seminara, "Human Factors in the USSR," (Part 1), Applied Ergonomics, 1979, Vol. 10, No. 4, 201-210; and "Human Factors in the USSR," (Part 2), Applied Ergonomics, 1980, Vol. 11, No. 1, 23-30). Additional information came from an article by Professor Vladimir Munipov. (V. Munipov, "Applied Ergonomics in the USSR," Applied Ergonomics, 1978, Vol. 9, No. 4, 215-222), and "The development of the scientific basis of ergonomic norms and requirements," Applied Ergonomics, Vol. 15, No. 3, 179-183. Dr. Munipov is on the Editorial Board of Applied Ergonomics. A lecture by Anthony J. Cacioppo, Dept. of Biomedical Engineering, Wright State University, Ohio, provided insight about some US/USSR comparisons regarding human factors research and USSR personnel working in the human factors field. (A.J. Cacioppo, "Commentary on Human Factors Engineering in the USSR", May 1986).

In the Soviet Union, ergonomics is defined as one of the trends in the systems approach to investigation of man under particular conditions of his activities, while using all kinds of machines. The aim of ergonomics is the optimal adjusting to man of the means, processes and conditions of performance, having for its main subject matter the man-machine system.

Psychologists and ergonomists are not perceived as being able to contribute much in equipment design areas, though the USSR is developing ergonomics standards.

The journal Questions of Psychology (Voprosy psichologii) regularly publishes articles on ergonomics and engineering psychology.

Other than anthropometric studies, the USSR doesn't have separate laboratories studying physiology. The term used to describe physiological studies linked with psychological factors is "Psychophysiological."

Ergonomics' Role

All the ergonomic departments and laboratories, including the head department in Moscow, participate in working out designs of industrial products of various kinds and make expert evaluation of ergonomic characteristics of products to be selected for awarding the State Quality label. Much research is devoted to design, construction and utilization of automatic control systems. Ergonomics is now coming to a systems approach in studying and modeling man-machine interaction, including man-computer interaction.

USSR (cont)

Ergonomists work on tasks of effective organization of a space ship team's performance, paying special attention to studying motivation, physiology of the working organism, psychological climate, group interaction, and psychophysiological aspects of cosmonaut's leisure time organization. Aviation ergonomics works with problems of effective pilot-equipment interaction under new performance conditions. Human factors problems became of vital importance in recent years for the shipbuilding industry, as complex automation of control processes is now one of the main directions of progress in the USSR sea fleets.

Seminara estimated in 1979 that there were about 2000 individuals in the USSR who are involved in ergonomics activities. They are affiliated with universities, agencies, military organizations and industrial laboratories. A 1974 conference of engineering psychology and ergonomics held in Yaroslavl attracted 3000 delegates with many engineers participating.

Anthony J. Cacioppo's keynote address on Soviet Ergonomics covered key performers, analytic tools, structure, research/application, and comparisons to western human factors engineering. Cacioppo listed the following as key performers in soviet engineering psychology:

V.M. Akhutin	simulation, mathematical models
A.B. Azarova	monitoring techniques
S.V. Borisov	complex systems, models
N.I. Boyko	applications-electronics
Yu.P. Dobrolenskiy	aircraft control
V.Y. Dubrovskiy	systems theory
B.A. Duskov	controls, selection, productivity
V.M. Gluskov	computer applications
M. Kotik	reliability control, operator performance
V.I. Lebedev	space system design
B.F. Lomov	methodology, systems theory, systems design, and space systems
V.I. Nilov	space systems design
V. Popov	space and aircraft systems
V.N. Pushkin	cybernetic applications to engineering psychology
V.F. Rubakin	decision making
M.R. Shagalov	work performance
V.N. Shilo	control-display interaction
B.A. Smirnov	human reliability, decision theory
O.K. Tikhomirov	artificial intelligence real time control systems
V.F. Venda,	information control, modeling systems.

USSR (cont)

Cacioppo said that the US clearly leads the Soviet Union in applications and handbooks, has a weak lead in equipment design, and is at parity in health and safety. Human factors areas where parity exists but is changing to a Soviet lead are industrial production, and automotive transportation.

Cacioppo described the US and USSR as being at parity in the human performances areas of temporal influences, environment, organisms, skilled performance, and vigilance. He said the US leads in displays, but is losing ground to the Soviets in control and information processing.

While maintaining a weak lead in personnel selection, the US is at parity in biotechnology, but losing ground in training, simulation, and work physiology. The USSR leads in cybernetics and sport psychology.

There is US/USSR parity in process control and automation but the US is losing ground to the USSR in cognitive engineering and human-computer interaction. Cacioppo said that in Soviet complex systems design, emphasis is placed on those systems elements where the payoff/cost ratio is the greatest.

USSR Institutions of Education and ResearchInstitute of Psychology, Moscow

The Institute of Psychology, Moscow, headed by Boris Lomov, is divided into five departments;

Theoretical and Experimental Psychology,
Neurophysiological Problems of Psychology
Engineering Psychology and Psychology of Labor,
Social Psychology, and
Philosophical Problems of Psychology.

Seminara visited only the Departments of Theoretical and Experimental Psychology, Neurophysiological Problems of Psychology, and Engineering Psychology and Psychology of Labor.

Department of Theoretical and Experimental Psychology

The Department of Theoretical and Experimental Psychology, directed by Artur Lebedev, deals with the relationship between memory span and different states of bioelectric activity of the brain. He currently is investigating physiological correlates of learning speed.

USSR (cont)

Department of Neurophysiological Problems of Psychology

The Department of Neurophysiological Problems of Psychology is directed by Vladimir Russalov, a physiologist. Russalov studies the basic characteristics or 'deep structure' characteristics of operator behavior. He has correlated EEG factors with a variety of behavioral characteristics of individuals, calling this relationship "ergicity." Another factor studied by Russalov was "level of synchronization," which links "speed of response" and problem solving characteristics of individuals with EEG patterns obtained from different parts of the brain.

Department of Engineering Psychology and Psychology of Labor

The Department of Engineering Psychology and Psychology of Labor, headed by Valery Venda, is concerned with engineering psychology problems and issues associated with automated systems, information display systems, multisensory information channels, mathematical modeling of human performance and methodological approaches for experimentation in engineering psychology.

The Engineering Psychology educational program includes:

- physiology of work,
- engineering psychology,
- industrial psychology,
- ergonomics,
- special practicum,
- engineering psychology as a design discipline,
- standardization,
- parametric statistics and non-parametric statistics,
- information processing and short-term memory,
- simulation, and
- workplace design.

The Department of Engineering Psychology and Psychology of Labor is planning and implementing a sophisticated, general purpose, computer-based simulator which will present alternate control-display approaches for monitoring and managing complex industrial processes. Dr. Venda feels that computer-based displays can and should be adapted to individual operator capabilities rather than the alternative approach of selecting operators who can cope with a given display format.

USSR (cont)

Laboratory for Special Problems, Department of Engineering
Psychology and Psychology of Labor

Within Venda's Department, Vladimir Popov heads the Laboratory for Special Problems, which is identified with human factors aspects of aviation and space systems. At the time of Seminara's report (1979), lack of simulation fidelity was regarded as a major problem for both space and aviation studies. Biomedical aspects of problems in spatial orientation in space, aircraft and sea activities have been studied well but little information is available on operator performance. Cockpit design and instrument theory are areas of great interest in pilot training programs. There has also been a long term interest in psycholinguistics as a cue to stress.

All-Union Research Institute of Industrial Design (VNIITE),
Moscow

The Director of the Institute is Y.B. Solovyov. Vladimir Munipov is Deputy Director at The Institute, also known as the All-Union Research Institute for Technical Aesthetics. The Institute's Moscow branch has a Department of Ergonomics with a staff of 60 people. Munipov is the principal coordinator for ergonomic research in all socialist countries.

By government decision the coordination of works in the field of ergonomics is performed by the All-Union Research Institute of Industrial Design, which has nine affiliated branches in the capitals of some Union Republics and big cities of the Soviet Union. In each of the branch offices there is a department or a laboratory of ergonomics, that works under a common plan and the methodological guidance of the head department of ergonomics in Moscow.

Munipov, in 1978 stated that numerous ergonomics studies are being carried out in many industries. (V.M. Munipov, ergonomics in the USSR", Applied Ergonomics, 1978, Vol. 9, No. 4, 215-222). The number of ergonomists working directly at plants has increased, with activities ranging from existing equipment to improving labor conditions.

USSR (cont)

Department of Ergonomics, Moscow Branch, (VNIITE)

The Department of Ergonomics in Moscow deals with:

- (1) theoretical and methodological problems of ergonomics,
- (2) visual processes in automatic control systems,
- (3) psychophysiological conditions of man in the process of work,
- (4) developing methods of building pre-design ergonomic models of workplaces,
- (5) anthropometry investigations, and
- (6) methods of computerizing ergonomic investigations.

Department laboratories, headed by Vladimir Zinchenko, evaluate consumer products and control panels, measure eye movements, EEG, EKG and GSR, and evaluate work space envelopes in terms of physical space requirements and anthropometric factors. Vladimir Zinchenko also holds the Chair for Work and Engineering Psychology at Moscow State University.

The first laboratory in the Department of Ergonomics consists of a noise-proof isolation chamber with recording instruments outside the chamber. The chamber is used for evaluation of consumer products and control panels. Measures of eye movements, EEG, EKG and GSR are taken in this laboratory also.

The second laboratory has an elaborate apparatus with a multitude of movable elements for expanding, contracting and shaping a work space envelope for an operator. One test involved placing a driver's seat and the controls for operating a tractor within the apparatus.

A third laboratory deals with visual capabilities for the user, and has a variety of instruments for presenting visual stimuli for pattern recognition tasks, decision-making problems, tachistoscopic presentations, etc.

The fourth laboratory visited by Seminara was designed primarily for eye-movement research used in evaluations of control panel designs.

USSR (cont)

Branch Offices, Department of Ergonomics, (VNIITE)

The Ural branch office performs a complex of physiological and hygienic studies and also works out methods of ergonomic evaluation of industrial product quality. The Ural office also specializes in machines and equipment for heavy industry and transportation.

The Kharkov branch develops ergonomic integral criteria and studies performance of automatic systems' operators.

The Byelorussian office studies agricultural machines and agricultural machine operators' performance, apparatuses of artificial blood circulation and ergonomic problems of microminiaturization.

The Leningrad office deals with problems of computer information presentation, machine tools, and the dynamic influence of lighting on human work.

The Armenian branch office studies operators' compensatory scanning activity in indeterminate automatic systems, and ergonomic aspects of trucks.

The Vilnius office is concerned with working posture investigation.

The Far East office develops techniques of estimation of human biases in the process of work.

The departments of Ergonomics in Moscow, Kharkov, and Kiev also specialize in design, construction and utilization of automatic control systems and means of information presentation.

Laboratory of Educational Psychology of Computer Users,
Institute of Scientific Psychological Researches, Kiev

The Institute has eighteen laboratories, each with its own work theme. Only the Laboratory of Educational Psychology of Computer Users performed work relevant to Seminara's interests. The laboratory has thirty psychologists and mathematicians working on a three year contract, teamed with a research staff of comparable size from the Institute of Cybernetics. The theme of research is the development of a special language to facilitate problem solving with computers along with a system of education for those performing data processing tasks.

USSR (cont)

Yaroslavl State University

Only Yaroslavl State University trains ergonomists, as this term is defined at the university, in the whole USSR. Yaroslavl also trains engineering psychologists and industrial psychologists. There are 250 students of psychology, 15 ergonomists and 35 engineering psychologists. The main research theme for the ergonomics teaching staff is the study of the eye as an organ and the central nervous system in relation to work tasks.

Students in the ergonomics specialty study the following subjects:

- (1) Introduction to ergonomics, general definitions, concepts and methods;
- (2) Influence of work on the state of the organism, (adaptation to work);
- (3) Biomechanics and anthropometry;
- (4) Characteristics of motions in work activities;
- (5) Work fatigue and methods for combating fatigue;
- (6) Hygiene of Labor; improving the work climate - noise, illumination, radiation, vibration, etc.;
- (7) Physiological foundations of ergonomics - methods for studying the workplace, criteria of difficulty and intensity of physical and mental exertions;
- (8) Ergonomics considerations in establishing work norms, how to improve the workplace to increase production;
- (9) Physiological foundations for selection and vocational guidance, physical requirements for different jobs, effects of disease and handicaps of various types, exercises to build work skills; and
- (10) Technical aesthetics (industrial design) from the physiological standpoint.

The above-listed courses are supplemented by courses in the psychology of labor and engineering psychology.

USSR (cont)STANDARDS

The USSR has developed several state standards relating to ergonomics. (V.L. Munipov, "Applied Ergonomics in the USSR, Applied Ergonomics, 1978, Vol. 9, No. 4, 215-222).

State Standard 2.116-71 includes ergonomic characteristics along with other groups of product properties.

State Standards 2.118-73, 2.119-73 and 2.120-73 require an ergonomic estimation of products as an obligatory element of the technical proposal and design.

State Standard 12.2.019-76, the standard for general safety requirements for tractors and agricultural vehicles, includes ergonomic requirements for cabins, workplaces and control levers.

Requirements for the design and production of school equipment, worked out by the Academy of Pedagogical Sciences of the USSR, include parts describing ergonomic requirements.

Munipov said that standardization has become the most important means of increasing the efficiency of the practical implementation of ergonomic achievements. Despite the practical necessity of solving standardization problems, the organizations of the CEMA member-countries could not speed up the development of ergonomics standards without creating a firm scientific basis.

V. BIBLIOGRAPHY

M Antalovits, G Kaucsek

"The Conceptual and Methodological Approach in Ergonomics Analysis" (Hungarian)
Ergonomia, 1976, 9/3, 121-126

Positions defined on some essential conceptual and methodological questions relating to ergonomics practice, then summary of methodological questions regarding technical realization and ergonomics analysis of man/machine environment system.

A Batogowska, Slowikowski J

Atlas antropometryczny doroslej ludnosci Polski dla potrzeb projektowania
Warszawa, 1974
Prace i materialy/IWP;Z.19

L Bartha

"The Scientific-Technical Revolution and Ergonomics" (Hungarian) Ergonomia, 1978, 11/4, 217-221.

Review of theoretical and practical problems of ergonomics. Tasks of ergonomists are outlined. The paper briefly outlines the results achieved within the Comecon ergonomics cooperation and also mentions further possibilities in the field.

L Bartha

"Comecon Ergonomic Cooperation for the Development of a Unified Methodology Regarding the Quantification of Means of Production" (Hungarian)
Ergonomia, 1976 9/4 221-223.

Actions taken in the course of Comecon ergonomic cooperation, difficulties in a unified methodology concerning qualification of machines and means of production from an ergonomic point of view.

Boi Thu de Gia Khai

Atlas Nhan Trac ecgonomi
Bo Yte vien ve sinh
Dich te Hoc, 1981
Vietnam

Anthropometric atlas, cited in Ergonomics: Principles and Recommendations.

A.J. Cacioppo

"Commentary on Human Factors Engineering in the USSR", May 1986
US/USSR comparisons regarding human factors research and USSR personnel working in the human factors field.

Constantin Botez

Psychology of Industrial Work, 1967
(Romanian) 455-pages.

V Cech, V Fiala

"Standardization in the Field of the Human Factor", (Czech)
Psychologie v Ekonomické Praxi, 1977,
12/4, 187-195, Czechoslovakia

Transfer of human science knowledge into technical and protective practice using the prescriptive form. This aims for the successive transformation of human science knowledge into prescriptive regulation, norms and standards. Refers to success of Skoda Pízen, (National enterprise).

A Chapanis

"Quo Vadis, Ergonomia?" (Hungarian)
Ergonomia, 1980, 13/2, 102-107.

Historical review of major phases of ergonomics development, beginning with establishment of man-machine relation through the systems concept, up to large systems as the main line of development of ergonomics. The author points out the possibilities of ergonomics in the near and distant future.

LD Chainova

"The Problem of Function Comfort" (Russian)
Tekhnicheskaya Estetika, 1974, No.12, 1-2.

Takes into consideration all the factors, physical and psychological, for a definition of 'functional comfort' and work efficiency, eg. legibility of diagrams, new explanation of tiredness.

Jozef Daniel

Psychological analysis of operator activities, 1975

J Daniel

The Basic and Present Tendencies of Soviet Ergonomics (Czech),
Syntezá, October 1975.

VV Davydov, VP Zinchenko, MV Lomonosov, VM Munipov

"Prospects for Development of Methodology of Ergonomics and Engineering Psychology in the USSR"
OBSHCHESTVENNYE NAUKI, N3, 1980, 103-116.

Reviewed work of Leont'yev, Lomov, Rozenblat, Anan'yev, Medvedev, 21 references.

VI Filatov, DA Matelenok

"Scientific Problems Concerning Occupational Safety and Health at the Present Stage of Technical Progress", (Russian)
Vseojuznyi Naucno-Issledovatel'skij

Institut Ohrany Truda VC SPS, Leningrad, USSR, 1977, 168 pages.

Abstract in CIS Abstracts (CIS78-1499). Twenty-three experts from the Leningrad Institute deal with methods and standards for workplace improvement.

LI Fruttus (Hungary)

"Report on the II Ergonomics Summer Academy,"
Ergonomia, 1980, 13/3, 117-121.

Questions of high importance for ergonomics. The role and method of activity analysis, testing and evaluation of loading and demand, personality testing methods in ergonomics (work psychology).

R Gerle

The Present Situation in Ergonomics Research Activities (Hungarian)
Ergonomia, 1977, 10/2, 70-72.

Experts from a Comecon meeting discussed the significance and importance of the ergonomics activity, trend of development and cooperation with other countries.

X. Glisznska

"Problems and Conditions of the Development of Industrial Psychology in the Polish People's Republic" (Czech)
Psychologie v Ekonomické Praxi, 1975, 10/3, 137-143.

Development and present state of industrial psychology in Poland. Relations between theory and practice concerning industrial psychology. Problems of industrial psychology in Poland, other countries.

VM Gosler

Fundamentals of Technical Aesthetics and Ergonomics (Manual)
(Russian)

Kalininskij Politechn

Inst. Kafedra Chimic Masinotr, 1974, 263 pages.

Chapters on systemization of subjects on technical aesthetics and ergonomics. Problems of design in USSR and abroad. Design process and design analysis. Fundamentals of Ergonomics. Man/machine environment system.

VF Guscin

"Examination of the Design Aspect Inventions" (Russian)
Lenizdat, Leningrad, 1975, 135 pages.

Discusses technical aesthetics, ergonomic fundamentals of design, anthropometric, biomechanical, physiological and hygienic demands on equipment and workshop design.

W Hacker, F Macher

"Progressive Labour Content in the Man-Machine Systems"
(Hungarian) Ergonomia, 1980, 13/3, 108-112.

Need for analysis of each working activity by the design engineer and technologist with respect to efficiency and personality of worker is promoted. Intellectual requirements psychological requirements, development of product, division of functions, information exchange between man and machine, etc. are discussed.

G Kiss

"An Account of the II International Ergonomics Conference of the Comecon Countries," (Hungarian)
Ergonomia, 1976, 9/3, 161-163.

Discussion of papers presented at the conference.

H Kulka

Why Ergonomics? 1980

German Democratic Republic

Karl Marx State Technical University.

Ju. I. Kundiev, AO Navakatik, VA Buzunov

"Occupational Hygiene and Physiology in Thermal Power Stations"
(Russian)

Izdatel'stvo 'Medicina', Moscow 1982, 222 pages.

Deals with technical processes and harmful factors in thermal power plants, conditions of plants, conditions of work, health engineering, medical surveillance of workers.

Yu. Kankanyan (correspondent) YM Zabrodin

"Conference Analyzes Human Factors Engineering"

Yerevan KOMMUNIST (Russian) 30 April 1984, p 4.

(Interview with Prof. YM Zabrodin, doctor, psychological science and deputy director of the Institute of Psychology. Zabrodin discussed engineering psychology, its importance in technology. Views training as a psychological process, sees equipment as essential for simulating processes.

Dietmar Keil

"Commentary on Start of Scientific Data Transmissions With USSR, East Berlin"

Informatik, in German, Vol. 31, No. 6, 1-5, JPRS-TTP-85-006, 26 February, 1985,

F Liptak

"Systems Concept and Its Application Possibilities in the Area of Ergonomics," (Hungarian)
Ergonomia, 1977, 10/1, 14-16.

There is a new discipline in the area of ergonomics which endeavours to utilize systems concepts. The author deals with application possibilities of systems concepts in the area of ergonomics based upon Czechoslovakian experience.

Va Lebedev, VA Krutov

"Indices of the Work Quality of a Man Operator in Spaceship Control,"

Space Biology and Aerospace Medicine, January 1975, 8/6, 68-73.

Parameters of the quality of man operator performance in spacecraft control, applied to design and planning.

BF Lomov

"The Analysis of the Operator's Activities in the Man-Machine System," (Russian)

Ergonomics, June 1979, 22/6, 613-619.

Summarizes movement of display/control design from machine centered to man-centered approach, considering the operator as a complete system, receiving signals from his instrument, other instruments, and from himself. Calls for further study of psychological theory of work.

O Matousek

"Ergonomics" (Czech)

Design v Teorii a Praxi, 1974, No.4, 1-2.

A history of the evolution of ergonomic research in the socialist countries: USSR, Czechoslovakia, Bulgaria, Romania, Hungary, Poland, GDR. The importance of concepts in ergonomics are dealt with such as classical and systematic ergonomics as well as the relationship between systematic ergonomics and practice.

VM Munipov, VP Zinchenko

Principles of Ergonomics, (Russian)

Universiteta, Moscow, 1979, 343 pages.

VM Munipov, et al.

"Basic Directions of Standardization of Ergonomic Requirements" (Russian)

Technicheskaja Estetika, 1978, No 2, 1-3.

These directions deal with 36 criteria: four functional, 11 hygienic, 15 physiological and psychological, two safety, and four psychological.

VM Munipov

"The Birth of the Concept of Ergonomics in the 20's and 30's," (Russian)

Tekhnicheskaja Estetika, 1975, No.6, 22-24.

Discusses work of Soviet researchers who established in 1918 the Institute of the Brain. The Institute of Work branched from this in 1921. The notion of ergonomics crystallized on basis of work by Wechterev and Gellerstein.

VM Munipov

"Ergonomics-Tasks and Perspectives," (Russian)
Tekhnicheskaya Estetika, 1975, 12/1, 1-4.

Introduction of ergonomic research results in the different fields of industrial production, building, transport, agriculture, and the power industry. Demonstrated a considerable increase in labor productivity and improvement of the quality of industrial products.

VM Munipov

"Applied Ergonomics in the USSR,"
Applied Ergonomics, 1978, 9/4, 215-222.

Stefan S. Mutafov

Anthropologic-Ergonomic Characterization
 of the Bulgarian Population, 1985

(Bulgarian), Summary language: English & Bulgarian
 LC GN58.B8A58 1985 (LC code)

pub in Sofia, Izd-vo na Bulgarskata akademiia na nauki, 1985
 155 pages, illustrations.

L Pakan

"Demands for Solving Human Problems With Non-Synchronized
 Systems"

(Czech) Prumyslov Design, 1978, No.2, 20-22.

Article discusses work place, arrangement, comfort, order, safety, hygiene, aesthetics, design and dimensional relations, location of control and signal elements development and design of man-machine, man-environment, and man-man relations.

VA Petruschik

"Some Methodological Principles for the Artistic Projection of
 the Objective Environment"

(Russian) Vyseisa Shkola, 1976, 87 pages.

The importance of ergonomics and psychology for the designer is stressed. Methods of psycho-physiological and ergonomics analysis of the working process are given.

M Prokopec

"Dimensional Characteristics of Men and Women in Czechoslovakia
 for the Purposes of Industry"

Ergonomics in Machine Design, Vol I,
 International Labor Office, Geneva, Switzerland
 18 pages, 9 references, 1969

Brief review of anthropometric surveys.

Puzyna, Czeslaw

Fighting Noise in Industry, 1974.
 Warsaw

- JL Seminara
"Human Factors in Bulgaria"
Human Factors, Feb, 1976, 18/1, 33-44.
- JL Seminara
"A Survey of the Status of Bulgarian Ergonomics
and Psychology"
Catalog of Selected Documents in Psychology, 1975, 5, 41 Pages.
- JL Seminara
"Bulgarian ergonomics revisited"
Applied Ergonomics, 1982, 13/1, 43-48.
- JL Seminara
"Survey of ergonomics in Czechoslovakia"
Applied Ergonomics, 1979b, 10/3, 155-163.
- JL Seminara
"Survey of Ergonomics in Poland"
Ergonomics, May 1979, 22/5, 479-505.
- JL Seminara
"Ergonomics in the German Democratic Republic"
Applied Ergonomics, September 1984, 15/3, 215-227.
- JL Seminara
"Ergonomics in Hungary"
Applied Ergonomics, December 1980, 11/4, 207-221.
- JL Seminara
"Human Factors in Romania"
Human Factors, October 1975, 17/5 477-487.
- JL Seminara
"Survey of the status of Romania psychology with special emphasis
on human engineering"
Journal Supplement Abstract Service (JSAS) of the American
Psychological Assoc., 1200 Seventeenth St., N.W., Washington,
D.C., 20036.
This is a more detailed report of Seminara's survey of
Romanian human factors, and status of psychology in Romania.
Refer to MS. No. 275.
- JL Seminara
"Human Factors in the USSR (Part I)"
Applied Ergonomics, 1979, 10/4, 201-210.
- JL Seminara
"Human factors in the USSR (Part II)"
Applied Ergonomics, 1980, 11/1, 23-30.

A Savayan (TRUD correspondent in Yerevan)

"Role of Engineering Psychology"

TRUD, 18 September 1984, p3.

Machines and robots have freed man from physical labor but placed burdens upon him that at times exceed his capabilities.

VA Shmagin

"Ergonomics and Automation" (Russian)

Mekhanizatsiya i Avtomatizatsiya Proizvodstva, 1976, No. 1, 38-40.

Sven Thiberg, et al.

Anatomy for Planners I: List of Literature Report 20

The National Swedish Institute for Building Research, Stockholm, 1965, 123 pages,

A Zeleny, O Matousek

"Putting the Human Element Back Into Work"

ILO Information, 1974, 2/5, 7 pages.

Role of ergonomics in improvement of working conditions by facilitating work and making it healthier. The contribution of the ILO for population and practical application of ergonomic knowledge.

VP Zinchenko, VM Munipov

Foundations of ergonomics (Russian)

Methods, history, present level of ergonomics. Ergonomics requirements for machines, workplaces, work environment. Soviet state standards of ergonomics requirements for man-machine systems are given, plus results of ergonomics research with international cooperation.

V Zinchenko, V Munipov

"Ergonomics and Design Stressed in New S&T Trends" (Russian)

PRAVDA, 2 February 1982, p3.

Ergonomics seen as the agreement between the physical and psychophysical capabilities and characteristics of the worker on one hand and the properties of the technical equipment (system) on the other.

V Zinchenko, V Munipov

"Problems and Perspectives of Ergonomic Research"

Psychologie v Ekonomike Paxi, 1975, 10/4. 206-220.

Ergonomics concerning optimization of labor means, conditions and working environment. Ergonomics and dialectic materialism and system approach. Difference between ergonomics in capitalist and socialist social systems, scope of psychology theory.

VI. ERGONOMICS RESEARCH TOPIC INDEX

ACCIDENT SOURCES	27
ACOUSTIC ANALYSES	30
ACOUSTIC INFORMATION	29
AIRCRAFT CONTROL	41
AIRCRAFT INDUSTRY	13, 14
AIRCRAFT ACTIVITIES	44
AIRCRAFT SYSTEMS	41
ALTRUISM, SOCIAL NORMS	30
ANTHROPOMETRIC ATLASES	7, 8
ANTHROPOMETRIC DATA	33
ANTHROPOMETRIC FACTORS	45
ANTHROPOMETRIC FEATURES OF WORKPLACES	23
ANTHROPOMETRIC STUDIES	40
ANTHROPOMETRICS OF WORKPLACES	23
ANTHROPOMETRICS, ERGONOMIC TOPIC	36
ANTHROPOMETRY RESEARCH	22
ANTHROPOMETRY, TAUGHT	47
ANXIETY IN THE WORK SETTING	21
ATTENTION, AS ASPECT OF MENTAL LOAD	12
AUTOMATED SYSTEMS	43
AUTOMATION IN INDUSTRY	7
AUTOMATION OF CONTROL PROCESS	41
AUTOMATION OF WORK	22
AUTOMATION, CASE STUDY FILM	19
AUTOMOBILE INDUSTRY	18
AVIATION ERGONOMICS	41
AVIATION SYSTEMS	44
BEHAVIOR, AGGRESSIVE	11
BEHAVIOR, COLLECTIVE	12
BEHAVIORAL CHARACTERISTICS	43
BIOELECTRIC ACTIVITY OF THE BRAIN	42
BIOMEDICAL ASPECTS OF SPATIAL ORIENTATION	44
BOREDOM	21
BRAIN POTENTIAL MEASUREMENTS	21
BRAIN WAVE CHANGES	29
BRAIN WAVE DATA	29
BRAIN, EEG PATTERNS	43
COCKPIT DESIGN	44
COLLECTIVE BEHAVIOR	12
CONFLICTING GOALS	28
CONSUMER PRODUCTS EVALUATION	45
CONSUMER PSYCHOLOGY	38
CONTAMINANTS, ENVIRONMENTAL	18
CONTAMINANTS, PROTECTION AGAINST	20
CONTAMINANTS, WORKPLACES	22

ERGONOMICS RESEARCH TOPIC INDEX (continued)

CONTROL BOARD ARRANGEMENT FACTORS	26
CONTROL PANEL DESIGN	45
CONTROL ROOM DESIGN	25
CONTROL ROOM, IMPORTED	38
CONTROL ROOMS, ASPECTS OF	26
CREATIVITY, RESEARCH	29
CREATIVITY, SCIENTIFIC	11
DATA FILES	9
DATA GATHERING FORM	12
DATA NETWORK	9
DATA SYSTEM, ERGONOMICS	28
DATA, ANTHROPOMETRIC	33, 36
DATA, WORKPLACE	18
DATA-GATHERING	36
DECISION THEORY	41
DECISION-MAKING	45
DECISION-MAKING, AND VISUAL STIMULI	45
DESIGN OF AUTOMATIC CONTROL SYSTEMS	46
DESIGN, AGRICULTURAL AND CONSTRUCTION	31
DESIGN, AND NATIONAL STANDARDS	33
DESIGN, AND USSR STATE STANDARDS	48
DESIGN, EXPERIMENTAL	11
DESIGN, MACHINE SYSTEMS	15
DESIGN, SHIP, ERGONOMIC SYSTEM	36
DESIGN, SPACE SYSTEM	41
DESIGN, WORK STATION	12
DISPATCH OPERATORS, SELECTION OF	26
DISPLAY DESIGN	12, 22, 26
DISPLAY, SIMULATOR	37
DISPLAY SYSTEMS	43
DISPLAYS, ARRANGEMENT	38
DISPLAYS, LEGIBILITY	31
EAR PROTECTION DEVICES	32
EDUCATIONAL PROGRAMS	10
EEG AND ANTHROPOMETRIC FACTORS	45
EEG FACTORS AND BEHAVIOR	43
EKG AND ANTHROPOMETRIC FACTORS	45
ENERGY EXPENDITURE	12
ERGONOMIC SYSTEM	36
ERGONOMICS CHECKLIST	12
EVOKED POTENTIAL	21, 29
EYE AND HAND MOVEMENT	22
EYE AS AN ORGAN	47
EYE-MOVEMENT RESEARCH	45
FATIGUE AND PUPIL DIALATION	35
FATIGUE RESEARCH	12
FATIGUE, AND ACCIDENTS	39

ERGONOMICS RESEARCH TOPIC INDEX (continued)

FATIGUE, INTENSE, AND EMPLOYEE TURNOVER	37
FATIGUE, MENTAL	21
FATIGUE, WORK	47
GSR (GALVANIC SKIN RESPONSE)	45
HAZARDOUS CONDITIONS	22
HUMAN PERFORMANCE, MODELING OF	43
HUMAN RELIABILITY	41
HYGIENE OF LABOR, COURSE OFFERINGS	47
HYGIENE RESEARCH	20
HYGIENE, WORK	2
ILLUMINATION STANDARDS	31
ILLUMINATION, AND WORK CLIMATE	47
ILLUMINATION, DEFECTS	35
ILLUMINATION, PLANT	38
IMPAIRMENT, AND VIBRATION	25
IMPAIRMENT, MEASURING DEGREE OF	33
INCENTIVE PAY	18
INCENTIVES AND STRESS	27
INCENTIVES, AND CHOICE OF SPORT	12
INCIDENCE AND CAUSES OF NEUROSES	25
INCIDENCE OF IMPAIRMENTS	25
INDUSTRIAL DESIGN	24, 47
INDUSTRIAL PHYSIOLOGY	23
INDUSTRIAL PRODUCTS DESIGN	40
INDUSTRIAL PSYCHOLOGY, APPLIED	21
INDUSTRIAL PSYCHOLOGY, COURSES	43
INDUSTRIAL PSYCHOLOGY, JOB ANALYSES	21
INDUSTRIAL PSYCHOLOGY, STUDENTS	34
INFORMATION DISPLAY DESIGN	22
INFORMATION DISPLAY SYSTEMS	43
INSTRUMENT THEORY	44
INSTRUMENTS FOR FIELD TESTING MACHINERY	19
INSTRUMENTS, DATA-GATHERING	27
INSTRUMENTS, EVALUATION	45
INSTRUMENTS, SCREENING	26
ISO STANDARDS	25
JOB ANALYSES	27, 31
JOB DESIGN	21
JOB ROTATION	19
LEARNING SPEED	42
LEISURE TIME ORGANIZATION	41
LIFTING OR CARRYING HEAVY OBJECTS	12
LOAD, ERGONOMICS	18
LOAD, METABOLIC	35
MACHINE DEFICIENCIES	27
MACHINE DESIGN	36
MANPOWER SHORTAGE	16

ERGONOMICS RESEARCH TOPIC INDEX (continued)

MANUFACTURING PROCESS	22
MANUFACTURING, ERGONOMIC CONSULTING	23
MASCULINE-FEMININE ROLES	30
MEASUREMENT DEVICES	36
MEASUREMENT FORCES	19
MEASUREMENT PROGRAMS	7
MEASUREMENT TECHNIQUES	35
MEASUREMENT, FATIGUE AND STRESS	21
MEMORY SPAN AND BRAIN ACTIVITY	42
MEMORY, NOISE EFFECTS	35
MEMORY, OPERATOR	15
MEMORY, SHORT-TERM AND INFORMATION PROCESSING	43
MEMORY, WECHSLER TEST	16
MENTAL FATIGUE	21
MENTAL LOAD	12,15,21
MENTAL PROCESSES	21
MENTAL STRESS	21
MINERS	18
MONOTONY	12,21,22
MOTION LOADING	8
MOTIVATION FACTORS	14
MOTIVATION, GROUP	26
MOTIVATION, STUDY OF	41
MOTIVATION, WORKER	19
MOTIVATIONAL ASPECTS OF EDUCATION	29
MOTIVATIONAL FACTORS	11,34,38
MOTIVATIONAL PROFILE	29
NEUROSES	14
NOISE	14,20,23,25 32,35,47
NOISE EFFECTS	35
NOISE LEVELS	18
NOISE RESEARCH	22,36
NOISE PROTECTION	8
OCCUPATION, MANPOWER SHORTAGE IN	16
OCCUPATIONAL DISEASE	14,18,23
OCCUPATIONAL MEDICINE	18,23
OCCUPATIONAL SAFETY	27
OPERATOR BEHAVIOR	43
OPERATOR PERFORMANCE	41,44,46
OPERATOR, HYPOKINESIS	8
OPERATOR, MATHEMATICAL MODELING OF BEHAVIOR	37
OPERATOR, WORK SPACE ENVELOPE	45
OPERATORS, HANDICAPPED	7
OPERATORS, INTERVIEWS WITH	19
OPERATORS, OBSERVATION OF	31

ERGONOMICS RESEARCH TOPIC INDEX (continued)

OPERATORS, SHORT-TERM MEMORY	15
OPERATORS, SINGLE VS. DOUBLE	35
OPERATORS, WORK SPACE	36
PACE OF WORK	12
PATTERN RECOGNITION	16, 45
PERFORMANCE CONDITIONS, AVIATION	41
PERFORMANCE, AND HYPOKINESIS	8
PERFORMANCE, AND WORKER ENVIRONMENT	38
PERFORMANCE, ASSESSING	39
PERFORMANCE, OPERATOR	44, 46
PERFORMANCE, PROCESSES AND CONDITIONS OF	40
PERFORMANCE, SKILLED	42
PERFORMANCE, WORK	17
PHYSICAL WORK LOADING	12
PHYSIOLOGICAL NORMS	10
PHYSIOLOGY OF WORK	43
PHYSIOLOGY, LINKED WITH PSYCHOLOGY	40
PHYSIOLOGY, OF THE WORKING ORGANISM	41
PILOT TRAINING	44
PLANT SAFETY, DEFICIENCIES IN	38
POSITIONS OF OPERATORS	36
POSTURE	12, 22, 46
PROBLEM SOLVING CHARACTERISTICS	43
PROCESSING OF VISUAL AND ACOUSTIC INFORMATION	29
PROTECTIVE DEVICES	32, 37
PROTECTION REQUIREMENTS	32
PSYCHOLINGUISTICS	30, 34, 44
PSYCHOLOGICAL STRESS	27
PSYCHOMOTOR TASKS	12
PSYCHOPHYSIOLOGY	12, 15, 28, 29
REACTION TIME	16, 31, 35
RELIABILITY	14, 16, 41
REPLACEMENT PARTS	19
RISK-TAKING	28
ROBOTIC APPLICATIONS	22
SAFETY AND COST	7
SAFETY IN LOGGING AND TRANSPORTATION	14
SAFETY PROTECTION	31
SAFETY REQUIREMENTS, TRACTORS, AGRICULTURAL VEHICLES	48
SAFETY, INDUSTRIAL	8, 20

ERGONOMICS RESEARCH TOPIC INDEX (continued)

SAFETY, RELATION TO ERGONOMICS AND RELIABILITY	16
SAFETY, WORK	22
SEA ACTIVITIES	44
SELECTION AND TRAINING	39
SELECTION CRITERIA	26
SELECTION OF ATHELETES	12
SELECTION OF WORKERS	16
SELECTION TECHNIQUES	38
SELECTION, PHYSIOLOGICAL FOUNDATIONS FOR	47
SENSORY PROCESSES	29
SHIP DESIGN, ERGONOMIC SYSTEM	36
SKILL DEVELOPMENT	21
SKILL LEVELS	7
SKILLED PERFORMANCE	42
SKILLS AND PERSONALITY TRAITS	26
SKILLS, INDIVIDUAL DIFFERENCES IN	38
SOCIAL AND WORKING CONDITIONS	14
SOCIAL ENVIRONMENT	11
SOCIAL NORMS	30
SPEECH DEVELOPMENT	30
STANDARDS FOR INDUSTRY	31
STANDARDS, COORDINATION	8
STANDARDS, ERGONOMIC	10
STANDARDS, ERGONOMICS	7
STANDARDS, HUNGARIAN	27
STANDARDS, LABOR SAFETY	20
STANDARDS, NATIONAL	23
STANDARDS, NOISE	32
STANDARDS, POLISH DESIGN	33
STANDARDS, USSR	48
STANDARDS, USSR ERGONOMICS	40
STANDARDS, WHOLE BODY VIBRATION LIMITS	18
STRESS FACTORS	27
STRESS, AND PSYCHOLINGUISTICS	44
STRESS, CONTRIBUTOR TO ACCIDENTS	39
STRESS, EMOTIONAL	12
STRESS, MENTAL	21
STRESS, MINERS	18
STRESS, TIME	15
STRESS, WORK	23
TACHISTOSCOPIC PRESENTATIONS	45
TEAMWORK	27
TEMPERATURE	22, 35
TEST FACILITIES, WHOLE BODY VIBRATION	18
TEST, FIELD	19
TEST, WORK SPACE	45
TESTS, AUDIOMETRIC THRESHOLD	31
TESTS, CREATIVITY	29
TESTS, NOISE ATTENUATION	32
TESTS, SELECTION	16, 26
TESTS, SIMULATOR-BASED	37
TIME PRESSURES	27

ERGONOMICS RESEARCH TOPIC INDEX (continued)

TIME STRESS	15
TIME STUDIES	36
TOXIC ELEMENTS	20
TRAINING AND JOB SELECTION	38
TRAINING AND ORGANIZATION	7
TRAINING, ERGONOMICS	15,17,33
TRAINING ISSUES	18
TRAINING PROGRAMS	19,20,36,44
TRAINING, PERSONNEL	39
TRAINING, PROGRAMS	10
TRAINING, VOCATIONAL	22
VIBRATION	14,18,19,20,22 23,25,32,36,47
VIBRATION LEVELS	25
VIGILANCE	15,26,42
VISUAL CAPABILITIES	45
VISUAL COMMUNICATION	36
VISUAL FATIGUE	31
VISUAL FIELDS	23
VISUAL INFORMATION	22,29
VISUAL PROCESSES	45
VISUAL SIGNALS	39
VOCATIONAL TRAINING	18,21,22
WHOLE BODY VIBRATION	18
WINDOW DESIGN	35
WORK ENVIRONMENT	22
WORK ENVIRONMENT	23
WORK LOAD	12
WORK PHYSIOLOGY	42
WORK STATION DESIGN	38
WORK POSTURE	12
WORK PROCESSES	22
WORK PSYCHOLOGY	11,25,26,27,37
WORK PSYCHOLOGY, BOOK TOPIC	38
WORK PSYCHOLOGY, COURSE OFFERINGS	27
WORK PSYCHOLOGY, COURSES	37
WORK SAFETY	20,27
WORK SKILLS, EXERCISES TO BUILD	47
WORK/REST CYCLE FACTOR	26
WORKER ORGANIZATION	19
WORKER SKILLS, DISTRIBUTION OF	19
WORKLOAD	17,21
WORKPLACE STUDIES	7,18,22,23,26 43,45,47,48
WORKPLACE DESIGN	43
WORKSTATION DESIGN	35

END

5-87

DTIC